

Real Analysis 2, MATH 5220

Homework 9, Munkres Section 52 and 53

Due Monday April 27, 2015 at 3:00

52.2. Let α be a path in X from x_0 to x_1 ; let β be a path in X from x_1 to x_2 . Prove that if

$$\gamma = \alpha * \beta \text{ then } \hat{\gamma} = \hat{\beta} \circ \hat{\alpha}.$$

52.3. Let x_0 and x_1 be points of the path-oriented space X . Prove that $\pi_1(X, x_0)$ is abelian if and only if for every pair α and β of paths from x_0 to x_1 , we have $\hat{\alpha} = \hat{\beta}$.

53.5. Let S^1 be the unit circle in \mathbb{C} , $S^1 = \{z = e^{i\theta} \mid \theta \in [0, 2\pi)\}$. Let $p : S^1 \rightarrow S^1$ be defined as $p(z) = z^n$ where n is some natural number. Prove that p is a covering map. HINT: As in the proof of Theorem 53.1, it is sufficient to show the result for point b in the open upper half of S^1 (why?).